

REMARKS

Reconsideration of this application, as amended, is respectfully requested.

Claims 29-31, 34-36, 38-46, and 50-57 have been rejected.

In this response, claims 31, 34, 41-44, and 52-55 have been amended. Claims 29-30 and 50-51 have been canceled. No new claims have been added. Support for the amendments is found in the specification, the drawings, and in the claims as originally filed. Applicants submit that the amendments do not add new matter.

Applicants reserve all rights with respect to the applicability of the Doctrine of Equivalents.

The Examiner stated that “should claim 29 be found allowable, claim 50 will be objected to as being substantial duplicate thereof.” (Office Action, p. 2).

Without admitting that the Examiner’s objection is proper, applicants have canceled claims 29 and 50.

Claims 29-31, 41, 50, and 52 stand rejected under 35 U.S.C. §112, second paragraph.

Applicants have canceled claims 29-30, and 50.

Applicants have amended independent claims 31 and 41 and respective dependent claims to remove “relatively thick”.

Based on the amendments, applicants respectfully submit that the Examiner’s rejections of claim 29-31, 41, 50, and 52 under 35 U.S.C. §112, second paragraph, have been overcome.

Claims 29-31, 34-36, 38-39 and 50-57 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Publication No. 2003/0189215 to Lee et al. (“Lee”) in view of U.S. Patent No. 6,509,270 to Held (“Held”).

Without agreeing with the Examiner's rejection, applicants have canceled claims 29, 30, and 50.

Without agreeing with the Examiner's rejection, applicants have amended claim 31 to read as follows:

A light emitting device comprising:
epitaxial layers;
a first ohmic contact layer on a first surface of the epitaxial layers;
a reflective adhesive layer on the first ohmic contact layer;
a seed layer of a thermally conductive metal on the reflective adhesive layer;
a layer of a thermally conductive metal electroplated on the seed layer, and a second ohmic contact layer on a second surface of the epitaxial layers, wherein the first surface of the epitaxial layers and the second surface of the epitaxial layers are opposite surfaces.

(Amended claim 31)(emphasis added)

As set forth above, claim 31 has been amended to indicate that the adhesive layer is reflective. Support for the reflective adhesion layer can be found in the original disclosure. The specification, as originally filed, on page 5 lines 30-31 discloses that the "any light passing through the first ohmic contact may be reflected by the adhesion layer". Claim 31 has been further amended to indicate that the first and second surfaces of the epitaxial layers relate to opposite surfaces. Support for the first surface of the epitaxial layers and the second surface of the epitaxial layers being opposite surfaces can be found in the original disclosure. Figure 6 ,as originally filed, shows the arrangement of the first ohmic layer 20 and the second ohmic layer 30 on opposite surfaces of the epitaxial layers 14.

The Examiner has acknowledged that Lee "fails to specifically teach a seed layer formed of the thermally conductive metal and furthermore an adhesive layer formed on the first ohmic contact layer between the seed layer and the first ohmic contact layer." (Office Action, p. 5).

Accordingly, Lee fails to disclose a reflective adhesive layer on the first ohmic contact

layer; a seed layer of a thermally conductive metal on the reflective adhesive layer; a layer of a thermally conductive metal electroplated on the seed layer, and a second ohmic contact layer on a second surface of the epitaxial layers, wherein the first surface of the epitaxial layers and the second surface of the epitaxial layers are opposite surfaces, as recited in amended claim 31.

Held, in contrast, teaches a method for polishing a semiconductor topology. More specifically, Held discloses an adhesion layer between the copper layer 12 and the silicon semiconductor layer 10 (column 13 lines 40-59, Figure 5). In contrast, amended claim 1 refers to an adhesion layer between an ohmic contact layer and a seed layer of a thermally conductive metal. Moreover, amended claim 31 now requires the adhesive layer to be reflective. Held already does not disclose any adhesive layer arranged between layers of conductive metal of an ohmic contact layer and a seed layer, much less such an adhesive layer being reflective.

It is respectfully submitted that Held does not teach or suggest a combination with Lee, and Lee does not teach or suggest a combination with Held. It would be impermissible hindsight, based on applicants' own disclosure, to combine Lee and Held.

Lee addresses fabricating vertical structure LEDs. Held, in contrast, addresses polishing a semiconductor topography. One of ordinary skill in the art would hardly have found the polishing method of Held relevant to fabricating light emitting diodes, much less consult its teaching. For this reason at least, one of ordinary skill in the art would not have combined the teachings of Lee and Held to arrive at the invention defined by independent claim 31.

Furthermore, one of ordinary skill in the art would certainly not have modified the teaching of Lee to include a reflective adhesive layer between the p-contact 150 and the metal support layer 156. Referring to paragraph [0014] of Lee, it is described

that the n-metal contact 56 of the vertical GaN-based LED 50 is "beneficially formed from a high reflectively [sic] layer". One of ordinary skilled in the art would thus have been motivated to provide a reflective n-GaN buffer layer 124, so that light emitted from the InGaN/GaN active layer 126 is accordingly reflected by the n-GaN buffer layer 124 and emitted from the side of the epitaxial layers 124, 126, 128 on which the p-contact 150 and the metal support layer 156 are arranged.

Clearly therefore, providing a reflective adhesive layer between the p-contact 150 and the metal support layer 156 would result in light emitted from the InGaN/GaN active layer 126 being perpetually reflected by both the n-GaN buffer layer 124 and the reflective adhesive layer, thereby resulting in internal light reflection within the light emitting diode and reducing the efficiency of light output from the light emitting diode.

Furthermore, even if Lee and Held were combined, such a combination would still lack a reflective adhesive layer on the first ohmic contact layer; a seed layer of a thermally conductive metal on the reflective adhesive layer; a layer of a thermally conductive metal electroplated on the seed layer, and a second ohmic contact layer on a second surface of the epitaxial layers, wherein the first surface of the epitaxial layers and the second surface of the epitaxial layers are opposite surfaces, as recited in amended claim 31.

By requiring the claimed light emitting diode to have a reflective adhesive layer arranged between an ohmic contact layer and a seed layer of a thermally conductive metal, embodiments of the light emitting diode may have enhanced robustness due to the adherence of both the ohmic contact layer and the seed layer to the adhesive layer. Also, embodiments of the light emitting diode may also have an improved efficiency of light output from the second ohmic contact layer due to the reflection of the generated light by

the reflective adhesive layer.

Therefore, applicants respectfully submit that claim 29, as amended, is not obvious under 35 U.S.C. § 103(a) over Lee in view of Held.

Given that claims 31, 34-36, 38-39, and 52-57 contain some limitations that are similar to those limitations set forth above with respect to amended claim 31, applicants respectfully submit that claims 31, 34-36, 38-39, and 52-57 are not obvious under 35 U.S.C. §103(a) over Lee in view of Held.

Claims 40-46 were rejected under 35 U.S.C. §103(a) as being unpatentable over Lee as modified by Held, and further in view of U.S. Patent No. 6,319,778 to Chen et al. (“Chen”).

As set forth above, even if Lee and Held were combined, such a combination would still lack a reflective adhesive layer on the first ohmic contact layer; a seed layer of a thermally conductive metal on the reflective adhesive layer; a layer of a thermally conductive metal electroplated on the seed layer, and a second ohmic contact layer on a second surface of the epitaxial layers, wherein the first surface of the epitaxial layers and the second surface of the epitaxial layers are opposite surfaces, as recited in amended claim 31.

Chen discloses making light emitting diode. Chen fails to disclose a reflective adhesive layer on the first ohmic contact layer; a seed layer of a thermally conductive metal on the reflective adhesive layer; a layer of a thermally conductive metal electroplated on the seed layer, and a second ohmic contact layer on a second surface of the epitaxial layers, wherein the first surface of the epitaxial layers and the second surface of the epitaxial layers are opposite surfaces, as recited in amended claim 31.

It is respectfully submitted that none of the cited references teach or suggest a combination with each other. It would be impermissible hindsight, based on applicants' own disclosure, to combine Chen, Lee and Held.

Furthermore, even if even if Chen, Lee and Held were combined, such a combination would still lack a reflective adhesive layer on the first ohmic contact layer; a seed layer of a thermally conductive metal on the reflective adhesive layer; a layer of a thermally conductive metal electroplated on the seed layer, and a second ohmic contact layer on a second surface of the epitaxial layers, wherein the first surface of the epitaxial layers and the second surface of the epitaxial layers are opposite surfaces, as recited in amended claim 31.

Given that claims 40-46 contain some limitations that are similar to those limitations set forth above, applicants respectfully submit that claims 40-46 are not obvious under 35 U.S.C. §103(a) over Lee, in view of Held and Chen.

It is respectfully submitted that in view of the amendments and arguments set forth herein, the applicable rejections and objections have been overcome. If the Examiner believes a telephone conference would expedite the prosecution of the present application, the Examiner is invited to call the undersigned at (408) 720-8300.

If there are any additional charges, please charge Deposit Account No. 02-2666.

Respectfully submitted,
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Date: December 16, 2010

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